

E. APPLICANT'S COMMENTS

Claims 8-17, 19-31, 35, 37-38 are pending in this Application, with Claim 45 added and Claims 1, 2, 3, 4, 5, 6, 7, 36, 39 40, 41, 42, 43, 44 canceled without prejudice. No new matter is added by way of these amendments, and the amendments are supported throughout the Specification and the drawings. Reconsideration of Claims 8-17, 19-31, 35, 37-38 and favorable consideration of Claim 45 is respectfully requested. The Examiner's rejections will be considered in the order of their occurrence in the Office Action.

Paragraph 1 of the Office Action (Drawings)

The Applicant has canceled the claims having the language "an array of etched microchannels" without prejudice and reserves the right to later amend the drawings to illustrate the same and/or to argue the presence of the same in the originally filed patent application.

Paragraph 2 of the Office Action (35 USC 102)

The Official Action rejected as-filed Claims 1, 2, 4, 5, 7 under 35 USC 102(b) as being anticipated by Kobrinetz (U.S. Patent No. 5,768,103). The Applicant has canceled Claims 1, 2, 4, 5, 7 without prejudice and respectfully requests withdrawal of this rejection.

Paragraph 3 of the Office Action (35 USC 103)

1. Overview.

The Official Action rejected Claims 8-11, 15-17, 19, 23-26, 29, 31, 35, 37-44 under 35 U.S.C. §103(a) as being unpatentable over Patel (U.S. Patent No. 6,612,120). The Applicant respectfully disagrees with this rejection of these claims for at least the following reasons.

First, in proceedings before the USPTO, the Examiner bears the burden of establishing a *prima facie* case of obviousness based upon the prior art.¹ Second, "[I]n formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements, it remains necessary to

¹ *In re Bell*, 26 USPQ2d 1529, 1530 (Fed. Cir. 1993). *In re Oetiker*, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992).

identify the reason why a person of ordinary skill in the art would have combined the prior art elements in the manner claims.”²

The Court in *KSR Int’l. Co. v. Teleflex, Inc.* stated³:

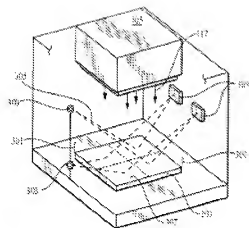
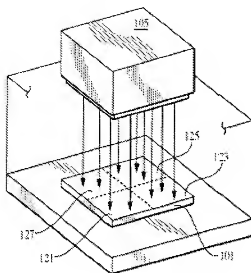
Often, it will be necessary ... to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was **an apparent reason to combine the known elements in the fashion claimed by the patent at issue.** To facilitate review, **this analysis should be made explicit.**

2. *Patel (U.S. Patent No. 6,612,120)*

Patel teaches a “semiconductor chip cooling system configured with thermal inkjet type sprayers controlled by a control system.” (Abstract) More particularly, Patel teaches the usage of “a large number of incremental sprayers, each configured and targeted to eject an incremental amount of the cooling fluid on a particular portion of the chip.” (Column 5, Lines 6-8.) Patel further states that “a preferred type of incremental spray for the spray head 105 is an inkjet-type sprayer.” (Column 5, Lines 55-57.) In Patel, the cooling surface of the chip 101 is divided into “regions” where a specific group of incremental sprayers only targets one region of the chip for thermal management. (Column 5, Lines 15-25.)

² USPTO Memorandum titled *Supreme Court Decision On KSR Int’l. Co., v. Teleflex, Inc.*, Margaret A. Focarino, May 3, 2007.

³ *KSR Int’l. Co. v. Teleflex, Inc.*, 127 S.Ct. 1727, 167 L.Ed.2d 705 (2007).



Patel (U.S. Patent No. 6,484,521)

The only means that Patel has to control the temperature of the chip is by adjusting the “flow rate”. Because Patel utilizes incremental sprayers (e.g. inkjet-type), it only teaches the “increasing or decreasing the frequency that a particular group of incremental sprayers is energized.” (Column 5, Lines 15-17.)

3. *Applicant’s Claims*

The Applicants currently pending independent Claims 8, 15, 23, 35 and 45 have the following features not present in Patel or the other cited references:

8. (Currently Amended) A spray cooling system comprising:
 a cooling surface with a hotspot zone producing a high heat flux;
 a sprayer in a spaced apart relationship to said hotspot zone and capable of transforming a supply of liquid coolant into a continuous and non-incremental pattern of droplets that impinge and create a thin coolant film within said hotspot zone;
 wherein said thin coolant film cools said hotspot zone primarily through evaporation; and
 wherein non-evaporated amounts of said thin coolant film dispensed within said hotspot zone creates a thicker coolant film over the remaining areas of said cooling surface.

15. (Currently Amended) A spray cooling system comprising:

an electronic component with a cooling surface having a hotspot zone producing a high heat flux;

a sprayer in a spaced apart relationship to said hotspot zone and capable of transforming a supply of liquid coolant into a continuous and non-incremental pattern of droplets that impinge and create a thin coolant film within said high hotspot zone;

wherein said thin coolant film cools said hotspot zone primarily through evaporation; and

wherein non-evaporated amounts of said thin coolant film dispensed within said hotspot zone creates a thicker coolant film over the remaining areas of said cooling surface.

23. (Currently Amended) A thermal management system comprising:

a cooling surface with a hotspot having a first heat flux;

an at least one sprayer in a spaced apart relationship to said hotspot and capable of transforming a supply of liquid cooling into a continuous and non-incremental pattern of droplets that impinge and create a thin coolant film on said hotspot;

wherein said thin coolant film absorbs said first heat flux;

wherein a radial flow of said thin coolant film creates a thicker coolant film over a second zone of said electronic component, said second zone producing a second heat flux that is less than one-third the magnitude of said first heat flux; and

wherein said thicker coolant film absorbs said second heat flux.

35. (Currently Amended) A liquid cooling system comprising:

an electronic component to be cooled having a cooling surface with a hotspot producing a first heat flux, wherein the non-hotspot portion of said cooling surface produces a second heat flux;

wherein said first heat flux is at least three times greater in magnitude than said second heat flux; and

an at least one sprayer in a spaced apart relationship and at a non-perpendicular angle to said hotspot, wherein said at least one sprayer dispenses droplets onto said hotspot in a continuous and non-incremental pattern that creates a thin coolant film on said hotspot and a thick film on said non-hotspot portion of said cooling surface, said thin coolant film capable of cooling said hotspot and said thick film capable of cooling said non-hotspot portion of said cooling surface.

45. (New) A spray cooling system comprising:

an electronic device having a cooling surface with a hotspot zone producing a high heat flux;

a sprayer in a spaced apart relationship to said hotspot zone and capable of transforming a supply of liquid coolant into a continuous and non-incremental pattern of droplets that impinge and create a thin coolant film within said hotspot zone;

wherein said sprayer is comprised of an atomizer;

wherein said thin coolant film cools said hotspot zone primarily through evaporation; and

wherein non-evaporated amounts of said thin coolant film dispensed within said hotspot zone creates **a thicker coolant film** over the remaining areas of said cooling surface; **at least one secondary orifice** for adding said coolant in a continuous and non-incremental manner to said thicker coolant film; and **at least one vapor management protrusion** surrounding said sprayer.

First, Patel teaches only “ink-type sprayers” which are not capable of spraying a liquid coolant in a “continuous and non-incremental patter” as featured in all of the independent claims. Second, Patel teaches only the usage of *“a large number of incremental sprayers, each configured and targeted to eject an incremental amount of the cooling fluid on a particular portion of the chip”* which is the opposite of the present invention which uses a single sprayer to thermally manage two zones with the second zone not “targeted” by the sprayer (Column 5, Lines 6-8.) The usage of the ink-type sprayers does not provide the user with the ability to flood the portions of the electronic device outside of the hotspot. Ink-type sprayers operate solely upon “frequency” for evaporative cooling and are not designed to flood the remaining portion of the cooling surface which requires a significant volume of liquid coolant. This is the reason Patel teaches the usage of a plurality of ink-type sprayers directed at specific zones. Finally, there is simply no discussion within Patel of using a single ink-type sprayer to thermally manage adjacent zones with the run-off from a single sprayer.

Finally, Patel teaches only applying a thin coolant film to each of the zones with each individual ink-type sprayer and does not teach spraying a thin coolant film over a hotspot zone along with the creation of a “thicker coolant film over the remaining areas of said cooling surface”. The entire teachings of Patel is to use a plurality of ink-type sprayers for each “zone” based upon a frequency of coolant sprayed upon each zone of the cooling surface in a thin film manner. This is a significant feature of the present invention as it allows for efficient thermal management of a heat producing device.

For these reasons, among others, the cited references cannot establish a *prima facie* case of obviousness, and it is therefore submitted that the rejection against Claims 8-17, 19-31, 35, 37-38 should be withdrawn and Claims 8-17, 19-31, 35, 37-38 allowed.

F. CONCLUSION

In light of the foregoing amendments and remarks, early reconsideration and allowance of this application are most courteously solicited. Should the Examiner consider necessary or desirable any formal changes anywhere in the specification, claims and/or drawing, then it is respectfully asked that such changes be made by Examiner's Amendment, if the Examiner feels this would facilitate passage of the case to issuance. **Alternatively should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, they are invited to telephone the undersigned.**

Respectfully submitted,

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CERTIFICATE OF ELECTRONIC FILING

I hereby certify that this correspondence is being filed electronically with the USPTO via ECF on August 22, 2007.

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